

PICSAT

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European Research Council
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Laboratoire d'Études Spatiales et d'Instrumentation en Astrophysique



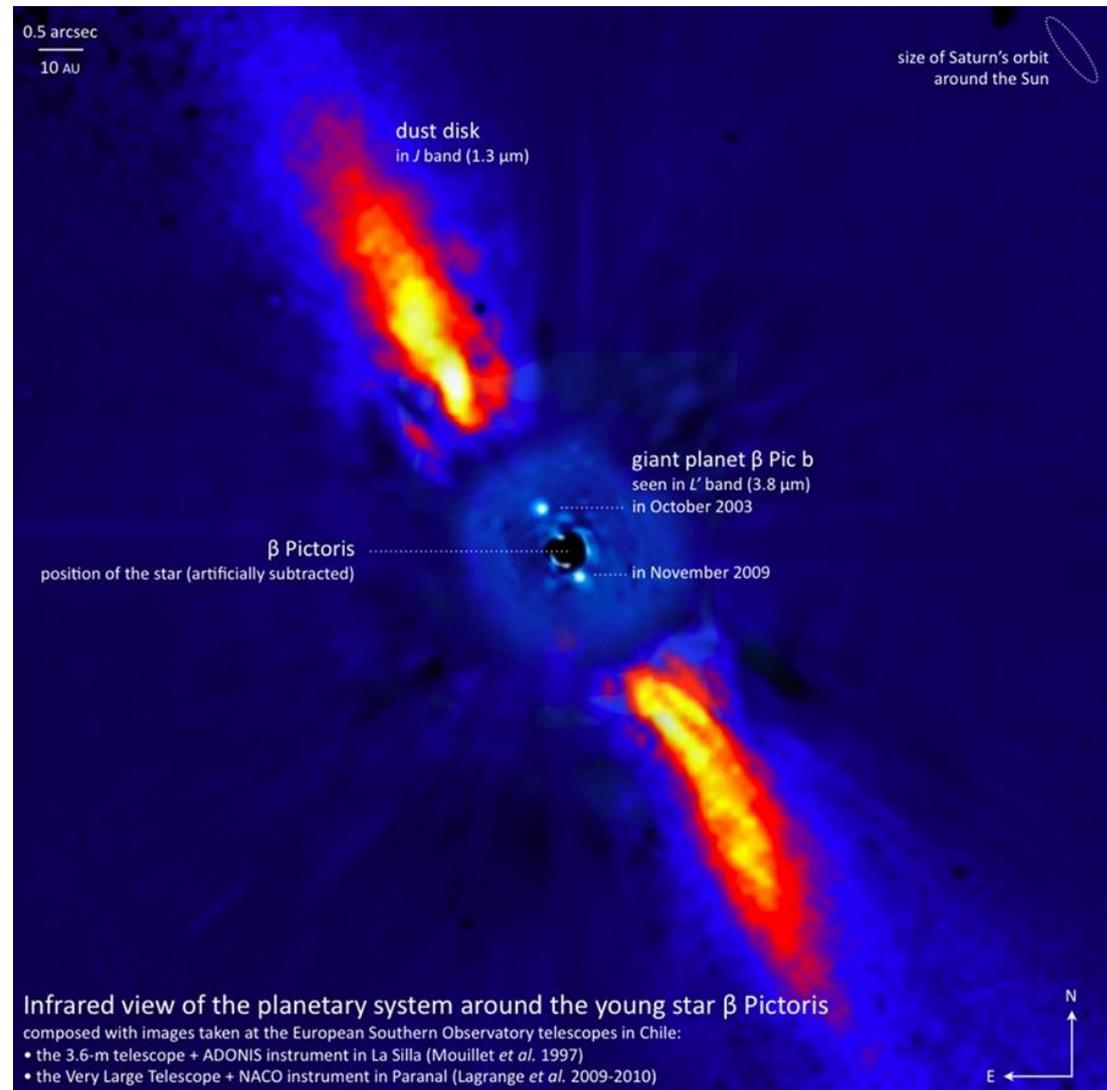
Science objectives

Main objective of PICSAT: constant monitoring of the photometry of Beta Pic, at ~ 100 ppm/hour accuracy to detect the transit (predicted for early 2018)

- Characterize the Hill Sphere
- Detect any orbiting material (rings, moons, if any)
- Inhomogeneities in the disk
- Detect exocomets in visible band

Tech demo:

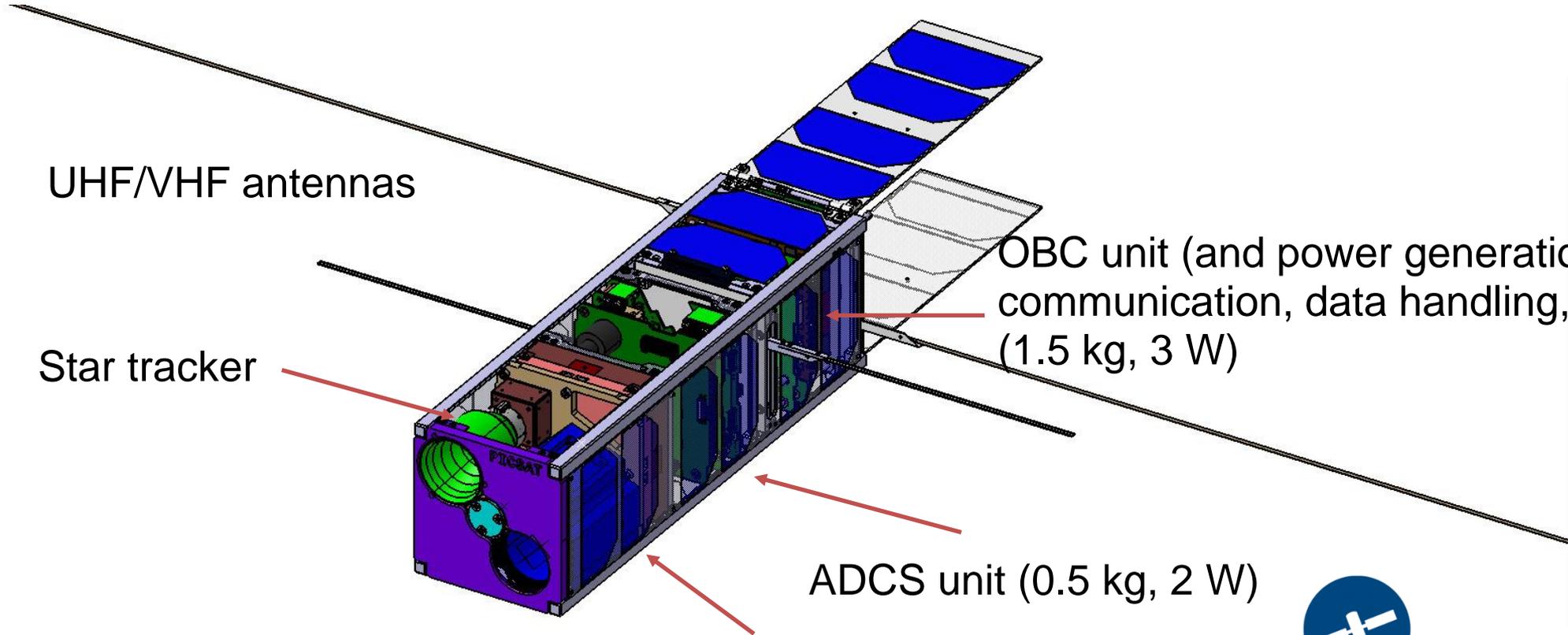
- Demonstrate our ability to inject starlight in a single mode fiber



Mission overview: satellite



Solar panels
on all sides + 4 deployable units)



UHF/VHF antennas

Star tracker

OBC unit (and power generation, communication, data handling, etc. (1.5 kg, 3 W)

ADCS unit (0.5 kg, 2 W)

Payload unit (1.1 kg, 2 W)
(also contains the Star Tracker)



HYPERION TECHNOLOGIES

Mission overview: ADCS

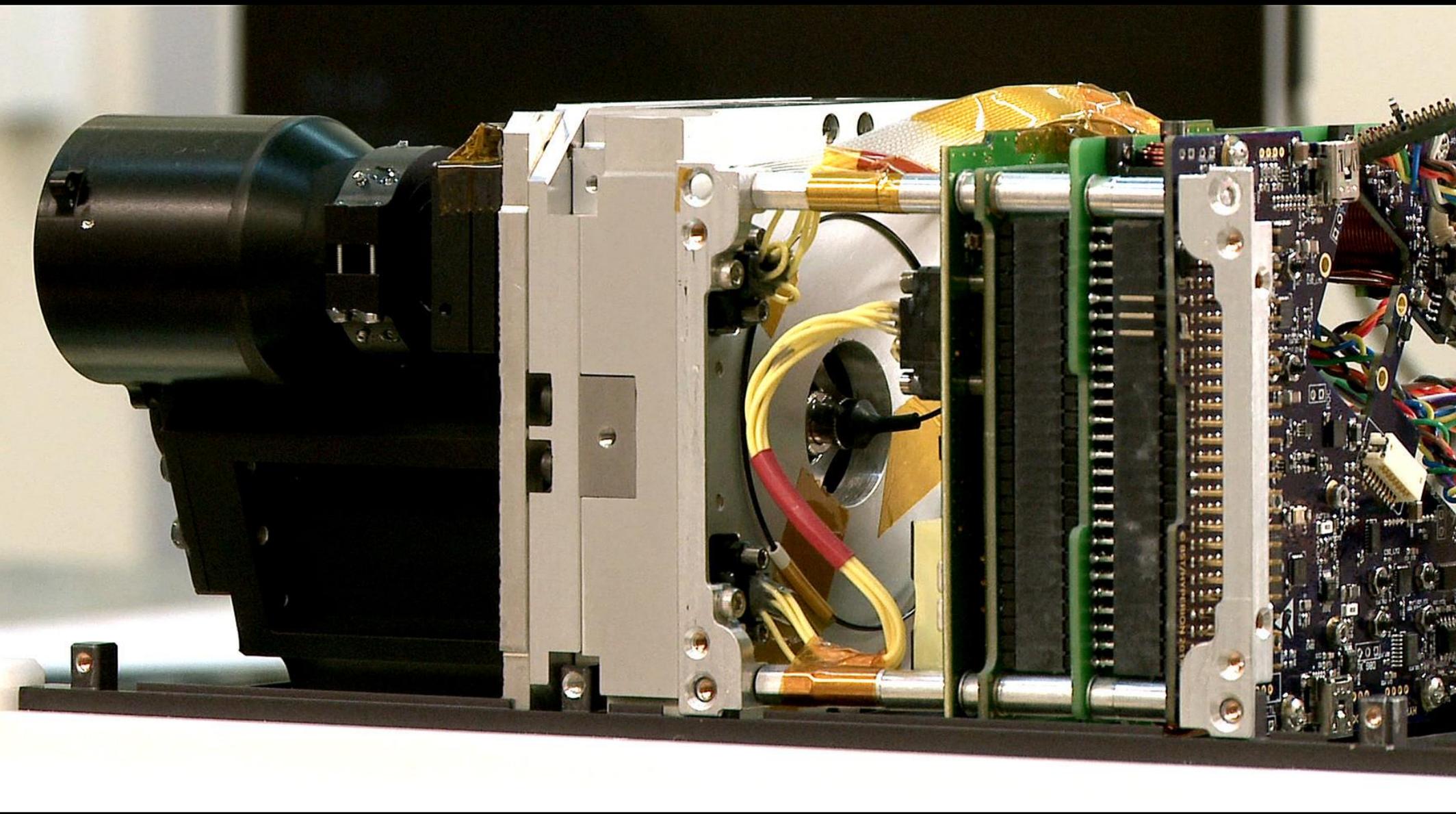
ADCS requirements for science mission:

- Detumbling (beginning of mission)
- Target pointing on beta pic (0.1 deg accuracy)
- Allocated power: 2W

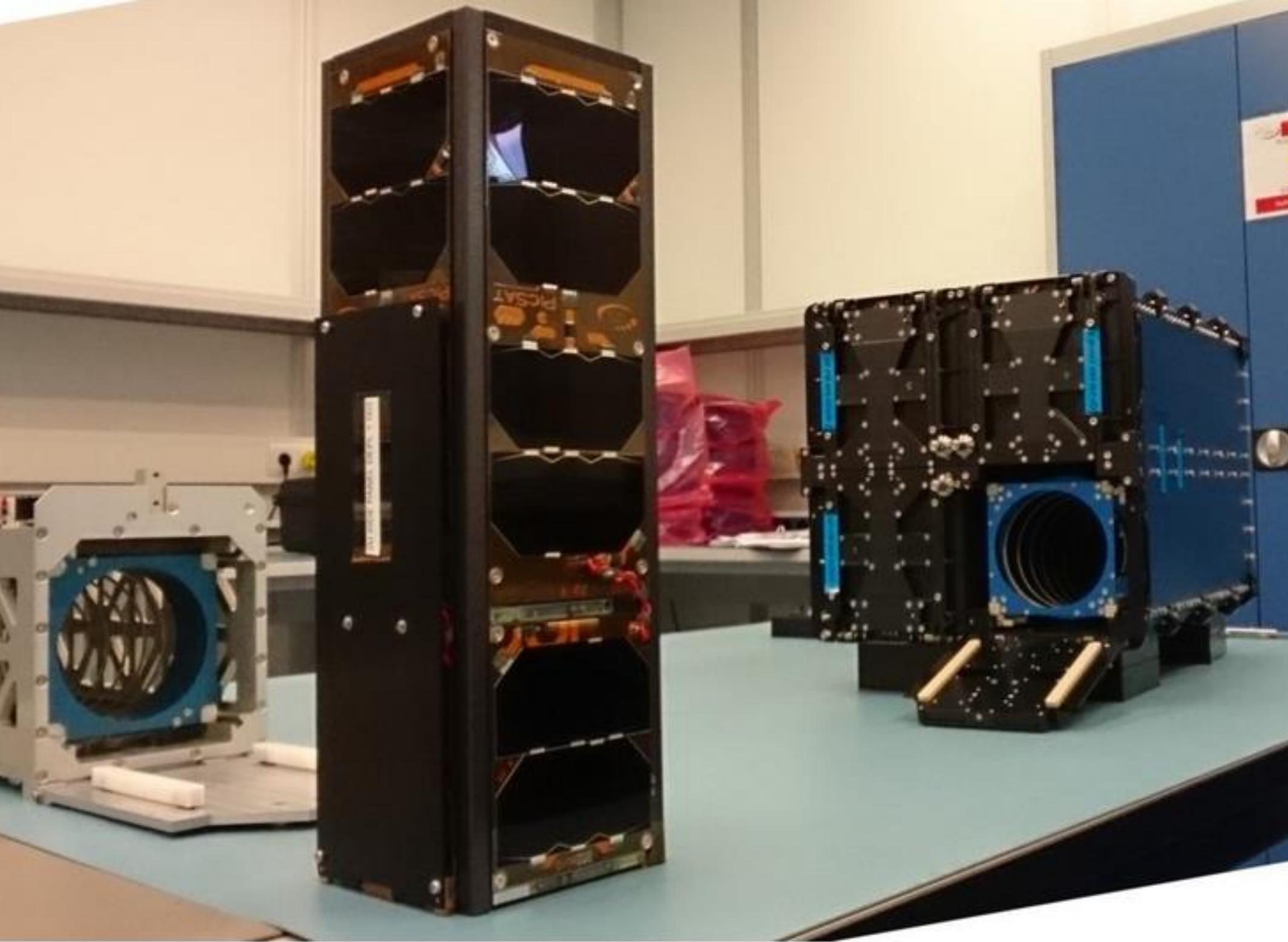
iADCS100 from Hyperion Technologies

- 3 axis control, with reaction wheels + mag. torquers
- includes built-in ST200 star tracker (30 arcsec accuracy)
- 1.4 W power consumption (nominal)
- “Fully autonomous, highly integrated system”
- “Target pointing, nadir pointing, sun-pointing, de-tumble”





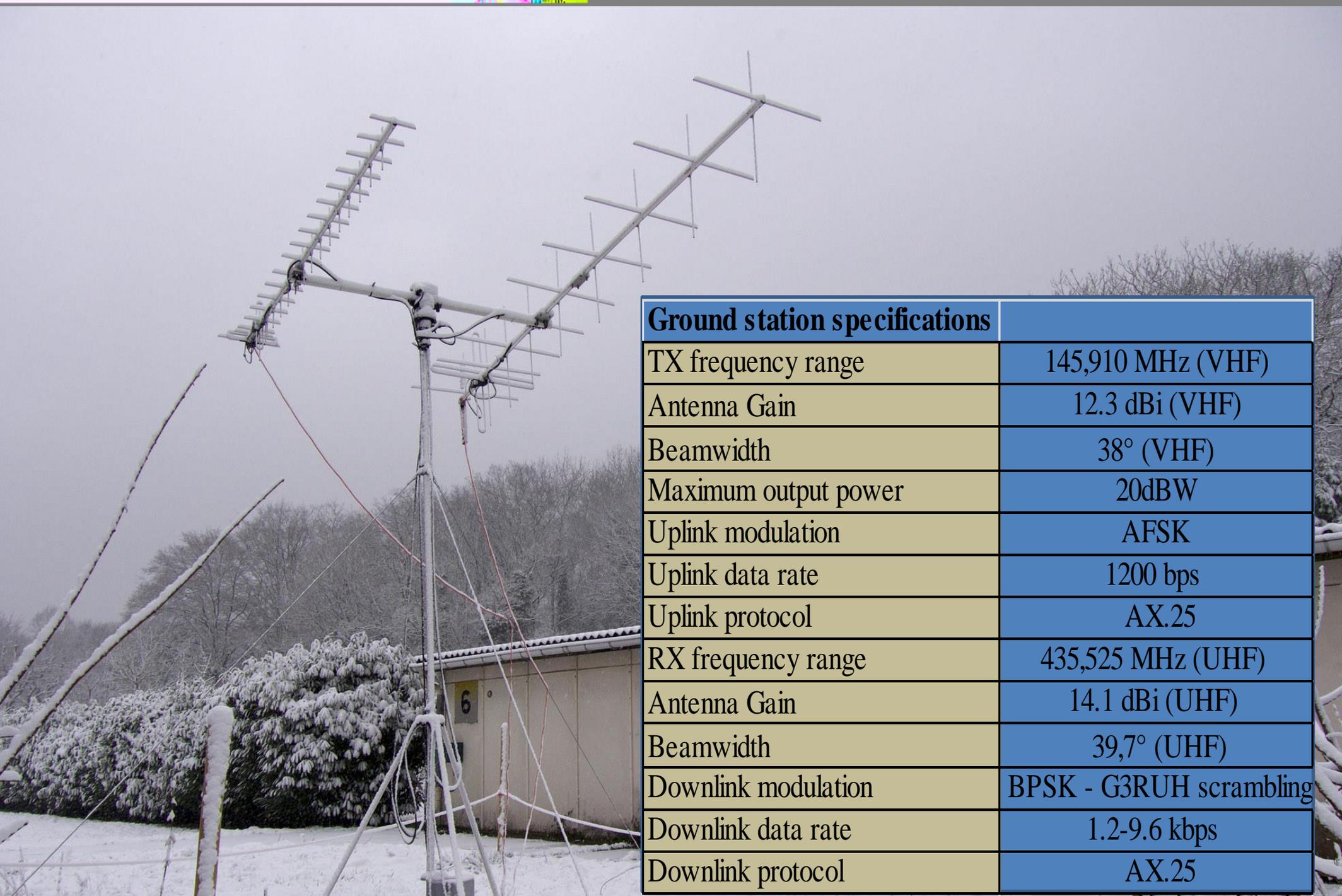




Launch on the PSLV-C40
January, 12, 2018



Operations: UHV/VHF ground station



Ground station specifications	
TX frequency range	145,910 MHz (VHF)
Antenna Gain	12.3 dBi (VHF)
Beamwidth	38° (VHF)
Maximum output power	20dBW
Uplink modulation	AFSK
Uplink data rate	1200 bps
Uplink protocol	AX.25
RX frequency range	435,525 MHz (UHF)
Antenna Gain	14.1 dBi (UHF)
Beamwidth	39,7° (UHF)
Downlink modulation	BPSK - G3RUH scrambling
Downlink data rate	1.2-9.6 kbps
Downlink protocol	AX.25

Operations: involving the radioamateurs

PICSAT communication frequencies:

- 145.900 MHz uplink
- 435.525 MHz downlink

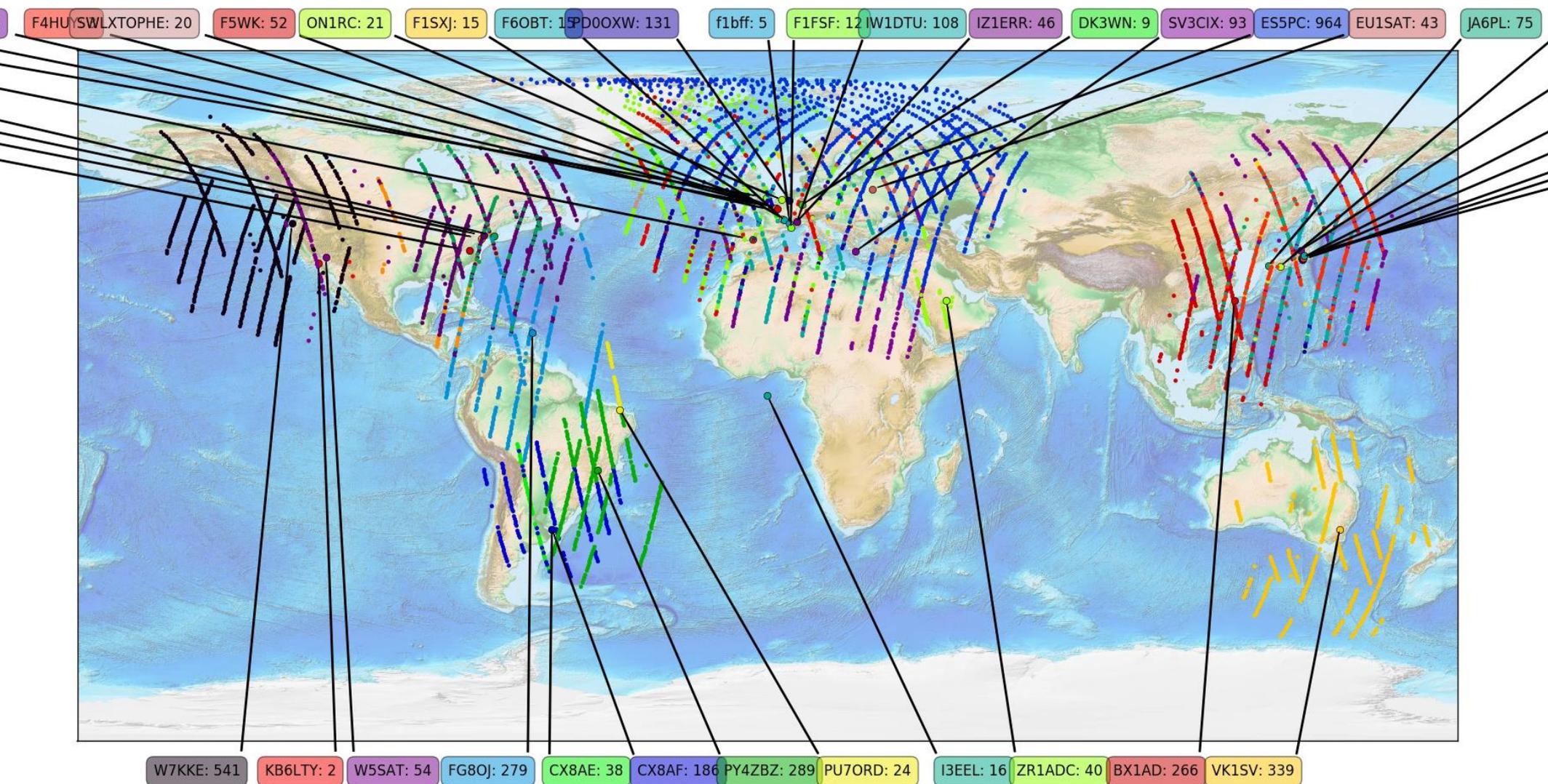
→ Radioamateur frequencies

We tried to involve radioamateurs in the project from the very beginning:

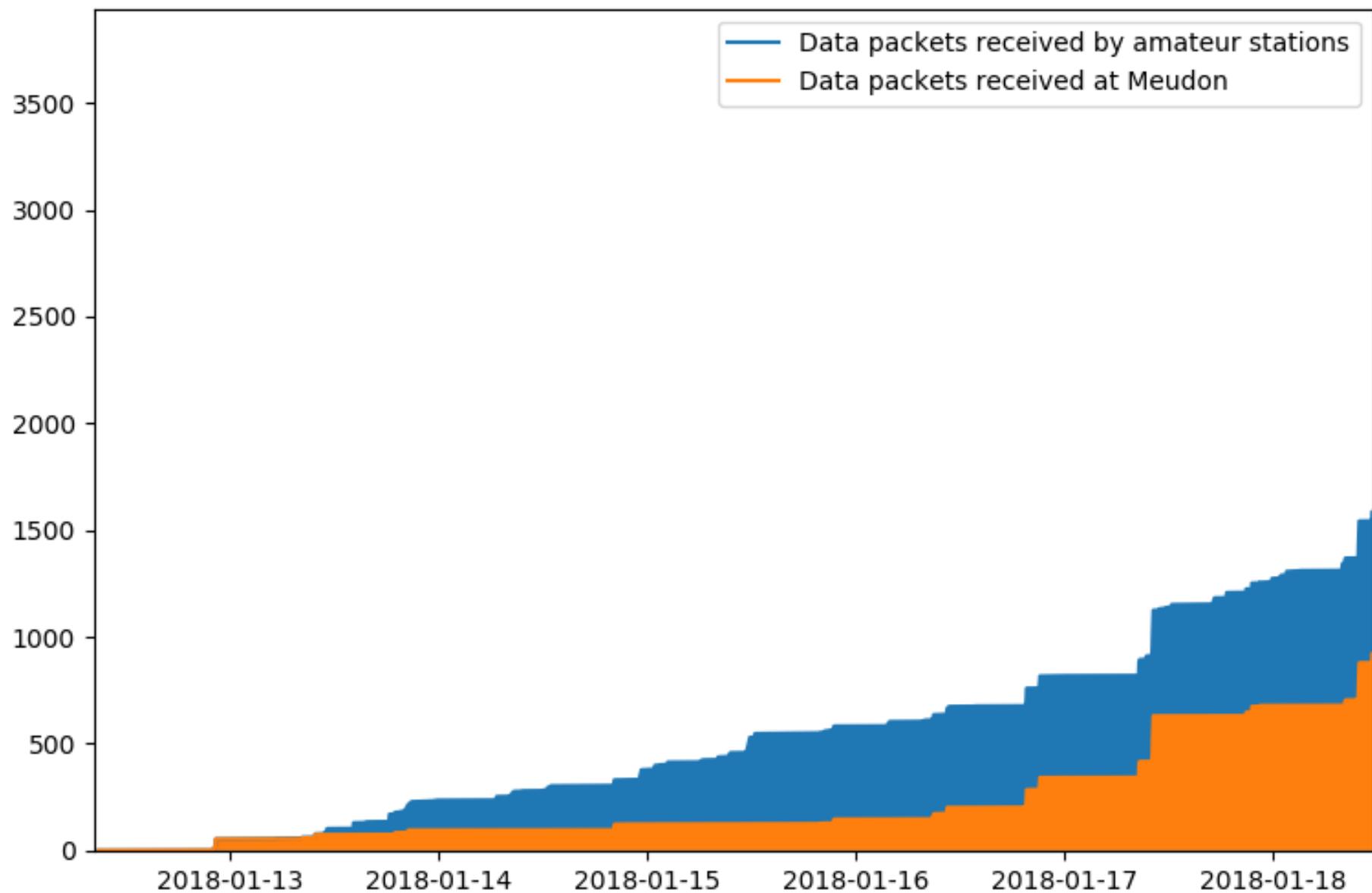
- Radio transponder on-board the satellite
- Mission website (picsat.obspm.fr) for data visualization and outreach
- @IamPicSat Twitter account to give feedback to the community
- Communication protocol and data format fully opened and accessible on the website
- SiDS server to automatically send the data frames to the mission database

Operations: HAM network

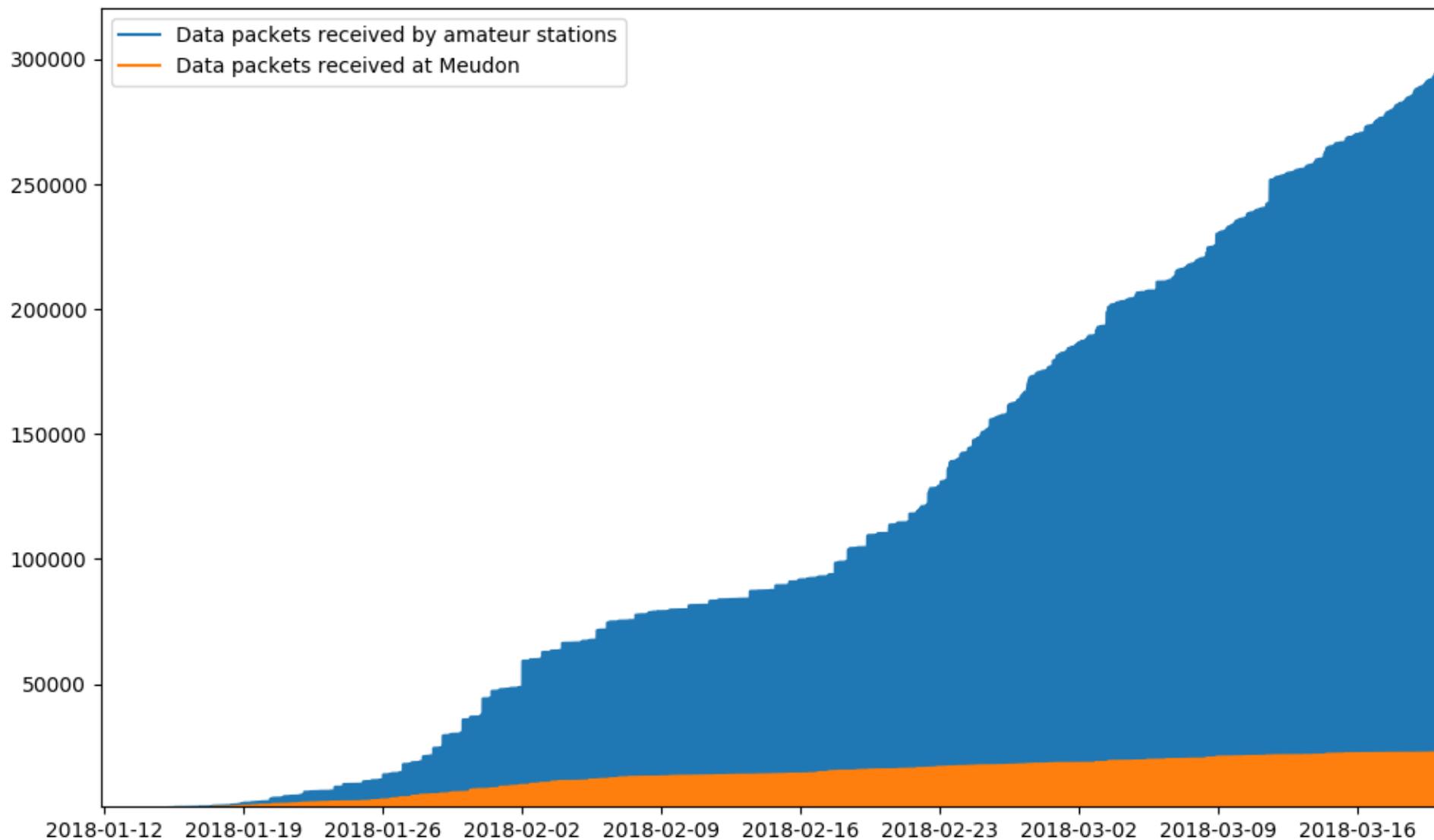
Beacons received from 2018-02-25 00:00:00 to 2018-03-01 00:00:00



Operations: HAM network



Operations: HAM network



Operations: timeline

January, 12, 1st pass over Meudon (5 hr after launch):

- Satellite beacon received
- Antenna deployment confirmed

January 12, 2nd pass over Meudon (6 hr after launch):

- First TC sent to the satellite, and first response seen
- Communication link established

January , 18 (6 days after lauch):

- Solar panel deployment command

January, 19 (7 days after launhed):

- Solar panel deployment confirmed

January, 25 (13 days after launch):

- Payload started

January 26 (14 days fter launch):

- Detumbling of the satellite to slow down rotation and get an ST fix

January 27 – March 20:

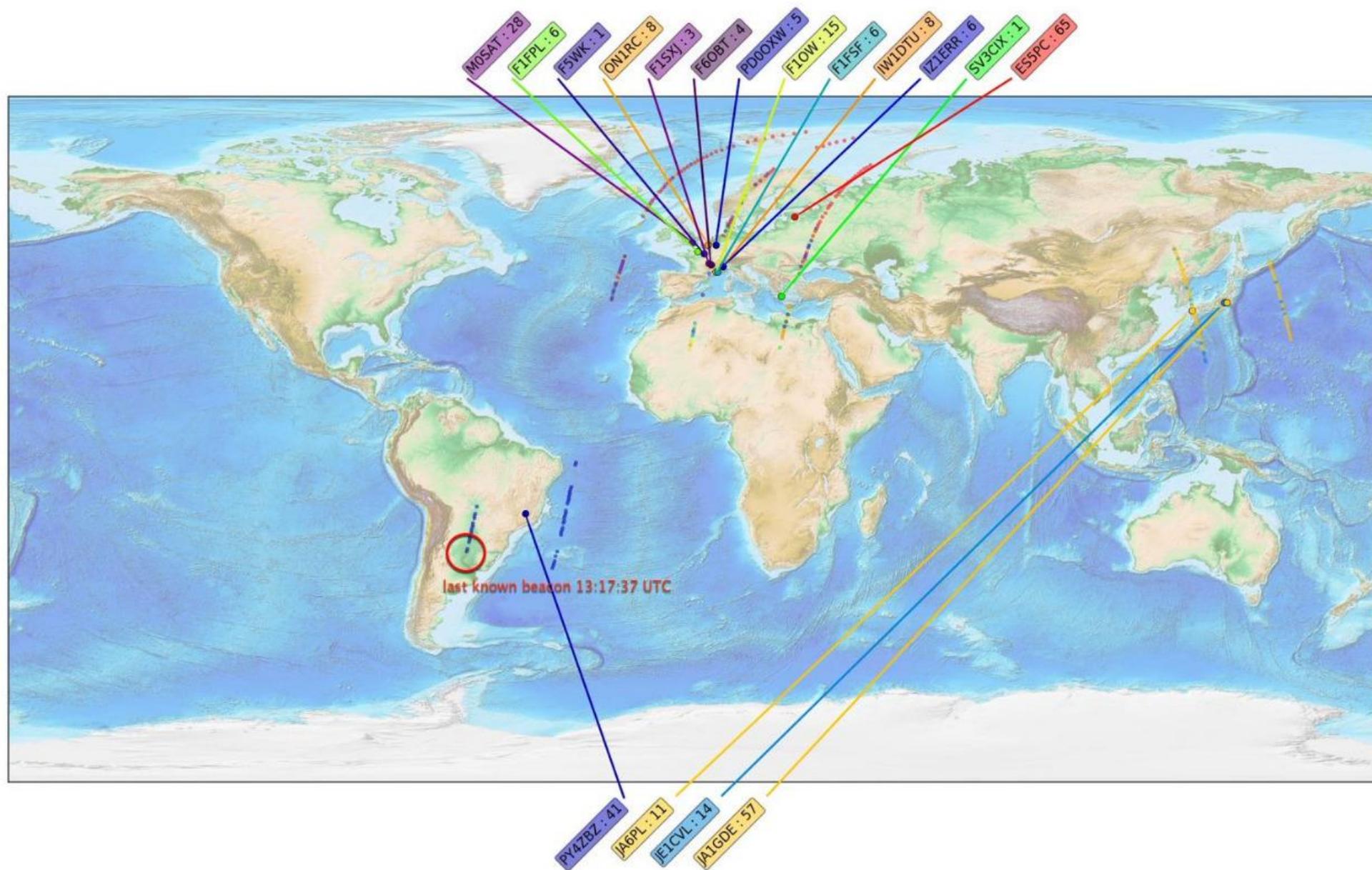
Target pointing?

Operations: what happened on March, 20?

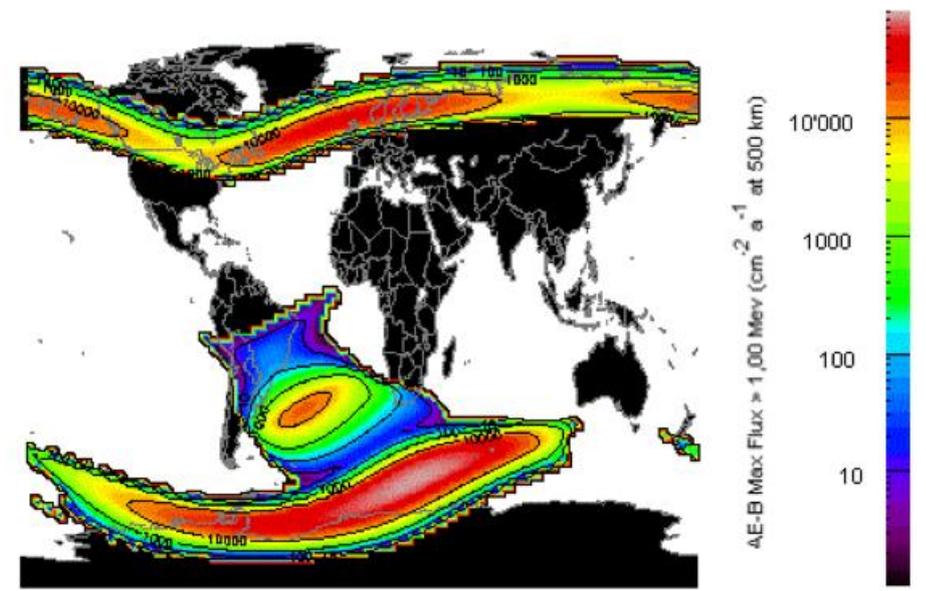
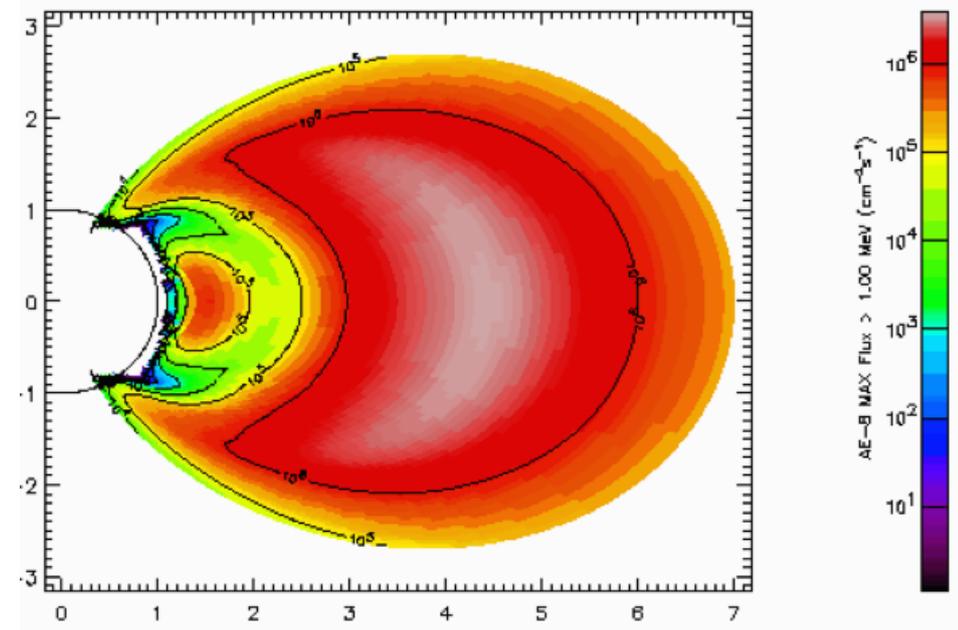
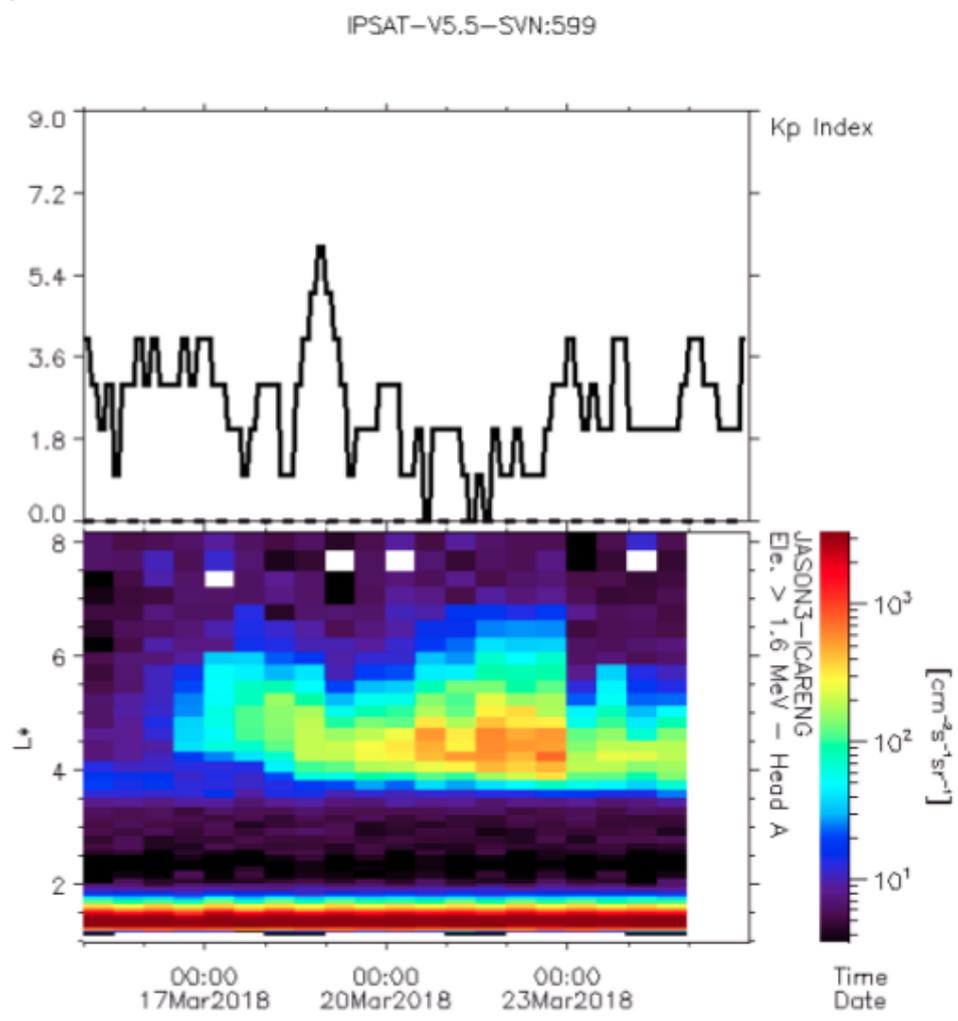


Operations: what happened on March, 20?

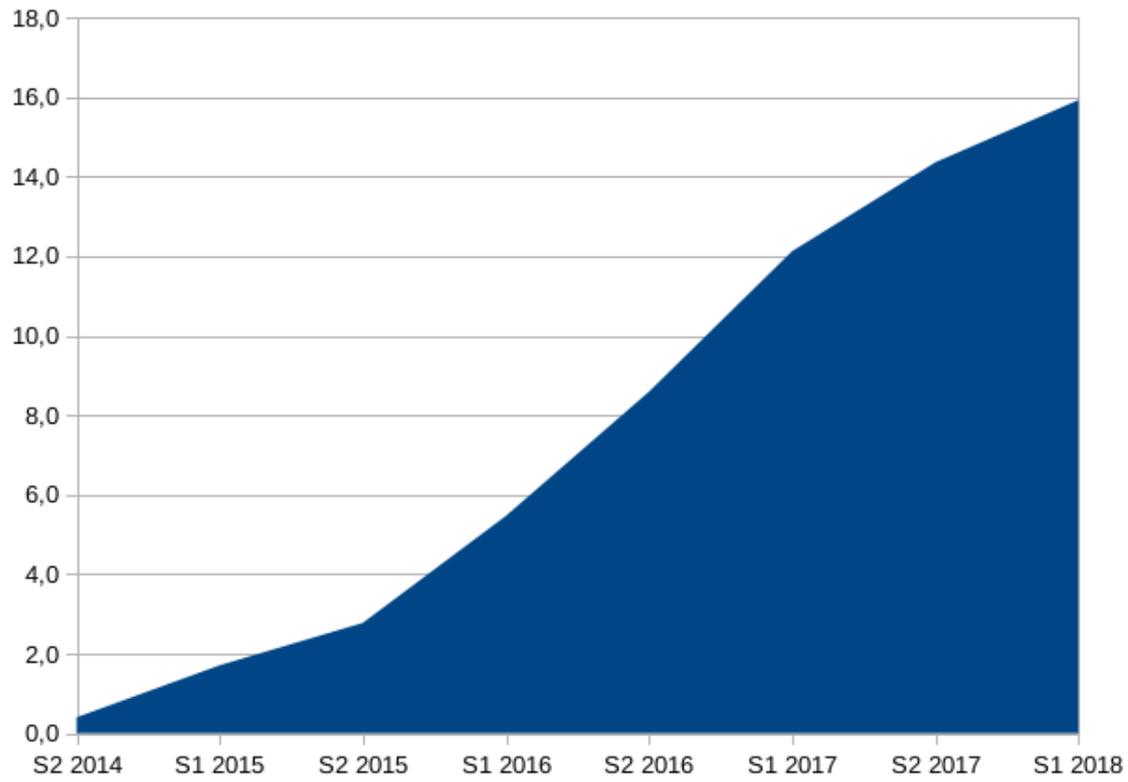
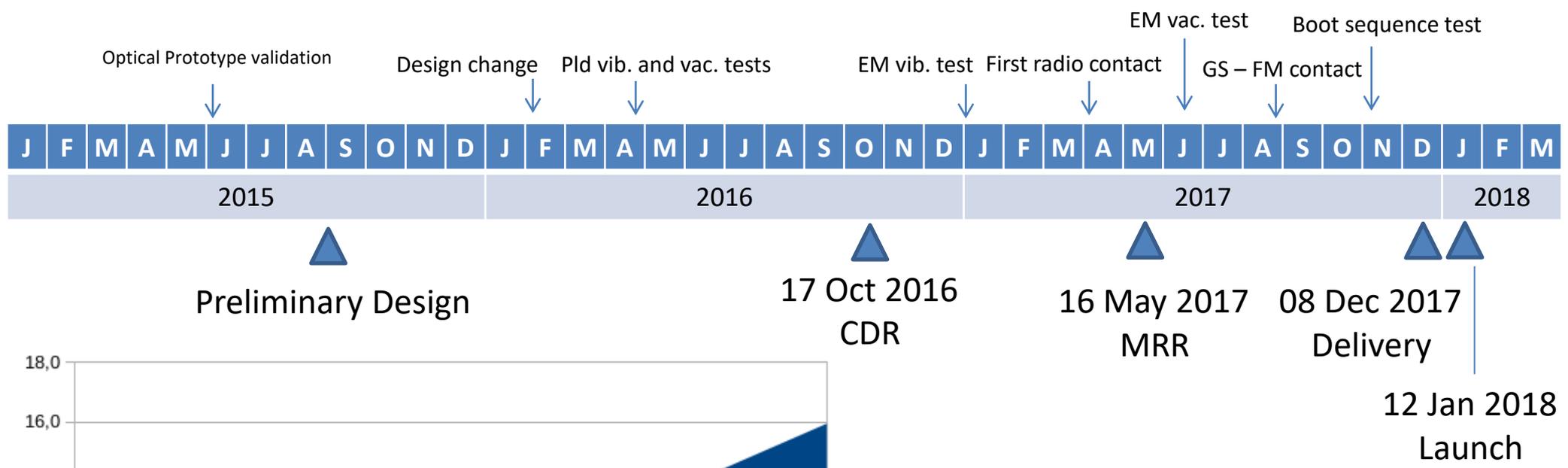
Beacons received from 2018-03-20 08:00:00 to 2018-04-01 00:00:00



Operations: what happened on March, 20?



In conclusion: the project timeline



■ FTE (cumulative)

**Total cost of the project:
US\$ 1.5 M**